**International Journal of Civil Engineering and Technology (IJCIET)**
Volume 8, Issue 3, March 2017, pp. 798–805 Article ID: IJCIET_08_03_080
Available online at http://www.iaeme.com/IJCIET/issues.asp?JType=IJCIET&VType=8&IType=3
ISSN Print: 0976-6308 and ISSN Online: 0976-6316



# ANALYSIS OF SOIL QUALITY FOR ENVIRONMENTAL IMPACT ASSESSMENT -A MODEL STUDY

**SS. Asadi**
Associate Dean Academics, Department of Civil Engineering, K L University, Vaddeswaram, Andhra Pradesh, India

**Kunati.Lahari**
B.Tech Student, Department of Civil Engineering, K L University, Vaddeswaram, Andhra Pradesh, India

**Koka.Sai Madhulika**
B.Tech Student, Department of Civil Engineering, K L University, Vaddeswaram, Andhra Pradesh, India

**ABSTRACT**

*Soil is a living system that represents a finite resource vital to life on earth. It forms the skin of unconsolidated mineral and organic matter on the earth's surface. It develops slowly from the various minerals and modified by time, climate, macro and micro-organisms, vegetation and topography. Soils are complex mixtures of minerals, organic compounds and living organisms that interact continuously in response to natural and imposed biological, chemical and physical forces. The present study is an attempt made to analyze the physico-chemical parameters around kothagudam thermal power plant. The soil samples collected at the predetermined locations are analysed for physico-chemical parameters. Soil quality parameters namely Bulk density, moisture content, Organic matter, pH, Electrical conductivity, Nitrate, Phosphorous, Potassium and Texture are prepared by using Graphical Representation. The physico-chemical analysis is helpful in the grouping of soil samples into excellent, good, poor, very poor and unfit. In the current study will be of much use for the planners in the management and monitoring of land resources.*

**Key words:** Physical Parameters of Soil, Organic compounds, unconsolidated mineral.

**Cite this Article:** SS. Asadi, Kunati.Lahari and Koka.Sai Madhulika, Analysis of Soil Quality for Environmental Impact Assessment-A Model Study. *International Journal of Civil Engineering and Technology*, 8(3), 2017, pp. 798–805.
http://www.iaeme.com/IJCIET/issues.asp?JType=IJCIET&VType=8&IType=3

# 1. INTRODUCTION

Soil is a vital part of the natural environment. It is just as important as plants, animals, rocks, landforms, lochs and rivers. It influences the distribution of plant species and provides a habitat for a wide range of organisms. It controls the flow of water and chemical substances between the atmosphere and the earth and acts as a source and store for gases (like oxygen and carbon dioxide) in the atmosphere. Soil is one of the most valuable natural resources available to us. It is very important for sustenance of life on the earth. The top soil which is suitable for plant growth is eroded due to human activities like construction of Thermal power plant, buildings, roads and expansions on the other hand the soil layers are contaminated deliberately due to Industrial pollution. The soils and its properties are affected to a great extent. The quality of soil is an function of its physical and chemical characteristics. Earlier, soil surveys have been carried out topographic maps and cadastral maps as data base. Soil surveys provide desired information on nature, location, extent and physico-chemical characteristics. EIA(Environmental impact Assessment) is the process by which the anticipated effects on the environment of a proposed development power plant project and also certain measures have been taken to reduce or avoid those effects .Large area of land is required for coal based Thermal power plant. Due to this natural soil properties changes and it becomes more alkaline due to the alkaline nature of fly ash. SPM (Suspended Particulate Matter) get deposited in the land which affects the soil. Spreading and Deposition of SPM on soil, disturb the soil strata thereby, the fertile and land use becomes less productive. The baseline environment quality represents the background environmental scenario of various environmental components during the study period. To extract and understand the soil characteristics of the study area for effective management of soil resources for the future development, Preparation of Environmental impact Assessment studies as per EIA notification, 2006 and its requirements. The EIA study will include the determination of baseline conditions surrounding to the proposed area, assessment of the impacts on the environment due to the construction and operation of the proposed project and making recommendations on the preventive measures to be taken, to minimize the impact on the environment to acceptable levels.

# 2. DESCRIPTION OF STUDY AREA

## 2.1. Topography

The study area is located at kothagudem of Khammam district in Telangana. The area is covered in part of survey of India Topographical sheet Nos. 65 C/6,7,10 and 11. The study area is well connected to kothagudem (5km) and the Khammam (80km), the district headquarters by the state highways. The study area is parts of the district are mainly hilly, Godavari, Tungabhadra and Khammam has the largest area under forests.

## 2.2. Rainfall and Temperature

Study area has a tropical climate. The summer here have a good deal of rainfall while the winters have very little. The average annual temperature is 28.1°c.precipitation here averages 1046 mm. the difference in precipitation between the driest month and the wettest month is 281 mm .throughout the year, temperatures vary by 112°c. The diversity of the physical features results in a corresponding diversity of climate.

# 3. OBJECTIVE

- Collecting of soil samples from the study area.
- Physico-chemical analysis of soil samples for estimation of soil quality.

# 4. METHODOLOGY

## 4.1. Data Collection

The different data products required for the study include the 65C/6,7,10,11 toposheets which is obtained from Survey Of India and fused data of IRS – 1C, PAN and IRS – 1D LISS-III satellite imagery obtained from NRSA, Balanagar, Hyderabad.

## 4.2. Data Input and Conversion

The study area is then delineated and subsisted from the data based on the latitude and longitude values and a final hard copy output is prepared for further interpretation.

## 4.3. Database Creation and Analysis

Geographical data is available in many different forms such as Toposheets .In the present study such as land are generated from Toposheet using Interpretation technique. The work involves environmental baseline data generation for which monitoring of one season environmental baseline data within the study area of 10km radius of the project site has been carried out. Details of environmental baseline data monitoring work for the project, showing different activities to be covered under these studies, activity-Wise samples, parameters to be monitored. It can also be assumed that, in almost all fields of science, there are de facto communities of specialists and scientists who care about the issues related to the formalisation, analysis and use of concepts and data. Land use and management practices greatly impact the direction and degree of soil quality changes in time and space. Understanding the effects of land use and management practices on soil quality and its indicators has been identified as one of the most important goals for modern soil science. This paper presents a method for assessing and mapping soil quality. Soils with higher quality were degraded more rapidly, because they usually need more nutrient input to maintain their quality status than those with lower quality. These analyses show that it is of equal importance to improve soil quality in degraded locations and to sustain it in high-quality areas.

Four soil samples were collected within available radial distance of the study area and were analysed to study the soil quality. Sample one (S1) is collected near temple at project site. Sample two (S2) is collected at Hemachandrapuram which is at a distance of 1.6km from the plant in the North-NorthEast direction. Sample three (S3) is collected at Gollagudem which is at distance of 1.5km from the plant in the East-NorthEast direction. Sample three (S3) is collected at Saravaram which is at a distance of 1.7km from the plant in the South-SouthWest direction. Soil quality Survey is performed on the four soil samples which are collected. From the analysis we can know the parameters of the soil samples such as porosity, Texture of the samples, silt content, claycontent, Electrical conductivity, Organicmatter%, Organiccarbon%, Na(sodium),Ca(calcium), Zn(zinc), Mg(Magnesium), Mn(Manganese), Hg(Mercury), Se(Selenium), B(Boron), Al(Aluminium), Cr(Chromium),Cu(copper),Fe(Iron), Pb(Lead).

**Table 1** Soil samples at different locations

| STATION CODE | STATION | DISTANCE FROM PLANT SITE (Km) | DIRECTION WRT PLANT SITE |
|---|---|---|---|
| S1 | Near Temple at Project Site | -- | -- |
| S2 | Hemachandrapuram | 1.6 | NNE |
| S3 | Gollagudem | 1.5 | ENE |
| S4 | Saravaram | 1.7 | SSW |

**Table 2** Soil Parameters

| S.NO | ACTIVITY | PARAMETERS TO BE MONITORED | SAMPLING PERIOD AND FREQUENCY | NO.OF STATIONS | TOTAL NO OF STATIONS PER SEASONS | MEASUREMENT METHODS |
|---|---|---|---|---|---|---|
| 1. | Soil quality survey | i)Soil depth<br>ii)Particlesize distribution<br>iii)Texture<br>iv)Organic matter<br>v)pH<br>vi)Electrical conductivity<br>vii)Exchangeable Cations and Cation exchange capacity (CEC)<br>viii)Alkali metals<br>ix)SodiumAbsorption Ratio(SAR) of soils<br>x)Heavy metals in soil viz, Cd, Cr, Pb, Ni, Cu, Zn, Mn<br>xi)Infiltration rate in mm/hr<br>xii) Water Holding capacity<br>xiii) Porosity | Frequency; One sample per station | 4 | 4 | Collected and analyzed as per soil analysis as per analysis reference book, M.I.Jackson and soil analysis reference book, by C.A.Black |

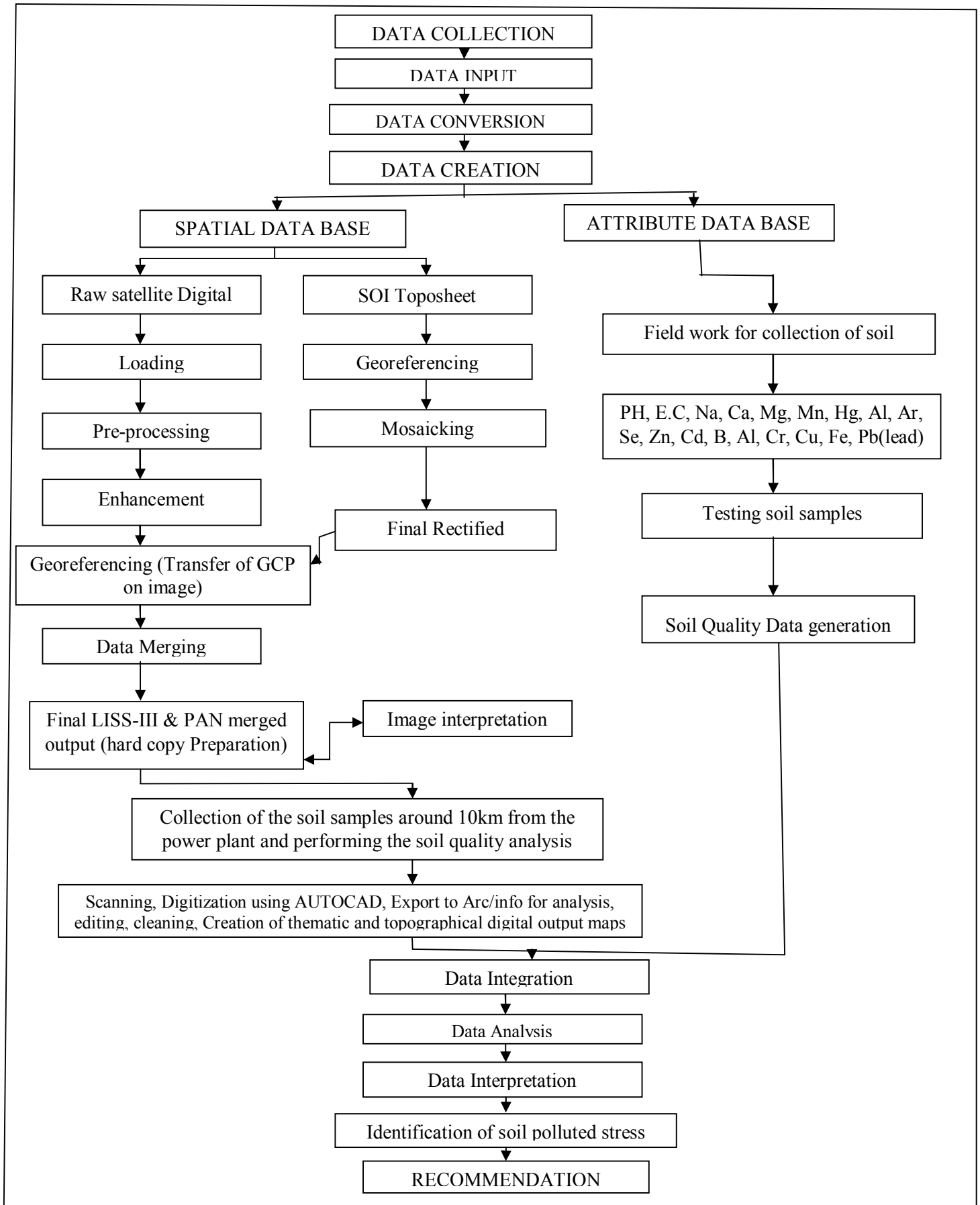


**Figure 1** Flow chart showing the methodology adopted for the present study

# 5. RESULTSAND DISCUSSION

## 5.1. Soil Quality Data

As per the above Methodology, soil sampling has been analysed .The detailed rate analysis has been prepared from the below table. The Texture of S1 is silty clay,S2 is clayey silt, S3 is sandy clay, S4 is silty clay. For silty clay the sand is 17.8, clayey silt the sand is 20.7, sandy clay the sand is 63.3, silty clay the sand is 14.5. The silt content is high in S3 and low in S2.The clay is high in S2 and low in S3. Porosity is high in S4 and low in S2. pH is more acidic in S1,S3,S4 and basic in S2. Electrical conductivity is low in S2 and high in S1. The percentage of Organic matter is low in S3 i.e (0.039) and more in S1(2.716). The percentage of organic carbon is low in S3(0.039) and more in S1(1.5). Sodium content is low in S1 and more in S2 .calcium content is low in S2 and high in S1 .Magnesium content is low in S2 and high in S3. Manganese content is low in S1 and high in S4. Mercury, Arsenic, Selenium contents is <0.001 in all the four samples .Zinc content is low in S3 and high in S4. Cadmium content is <0.001 in all the four samples. Boron content is low in S1 and high in S4. Aluminium is low in S2 high in S4. Chromium content is low in S2 and very high in S4. Copper content is low in S2 and high in S1. Iron content is low in S3 and more in S4. Lead is low in S2 and more in S1.

**Table 3** Soil Analysis

| **PARAMETERS** | **Results** | | | |
|---|---|---|---|---|
| | **S1** | **S2** | **S3** | **S4** |
| **Texture** | **Silty clay** | **Clayey silt** | **Sandy clay** | **Silty clay** |
| Sand | 17.8 | 20.7 | 63.3 | 14.5 |
| Silt | 47.4 | 32.0 | 5.8 | 42.8 |
| Clay | 34.8 | 47.3 | 30.9 | 42.7 |
| Porosity | 40.5 | 17.8 | 32.4 | 42.1 |
| PH | 6.85 | 8.75 | 6.95 | 5.75 |
| Electrical Conductivity | 207 | 179 | 202 | 197 |
| Organic matter % | 2.716 | 0.135 | 0.067 | 0.20 |
| Organic Carbon % | 1.5 | 0.075 | 0.039 | 0.11 |
| Na(Sodium) | 0.1 | 0.65 | 0.15 | 0.62 |
| Ca(Calicium) | 0.27 | 0.21 | 0.24 | 0.23 |
| Mg(Magnesium) | 0.09 | 0.015 | 0.01 | 0.05 |
| Mn(Manganese) | 263 | 302 | 283 | 703 |
| Hg(Mercury) | <0.001 | <0.001 | <0.001 | <0.001 |
| As(Arsenic) | <0.001 | <0.001 | <0.001 | <0.001 |
| Se(Selenium) | <0.001 | <0.001 | <0.001 | <0.001 |
| Zn(Zinc) | 65.0 | 47.0 | 37.0 | 78.0 |
| Cd(Cadmium) | <0.001 | <0.001 | <0.001 | <0.001 |
| B(Boron) | 6.750 | 8.216 | 8.973 | 10.06 |
| Al(Aluminium) | 4.90 | 4.860 | 5.06 | 7.01 |
| Cr(Chromium) | 48.0 | 37.0 | 38.0 | 110.0 |
| Cu(Copper) | 55.0 | 13.0 | 15.0 | 50.0 |
| Fe(Iron) | 1.83 | 1.46 | 1.24 | 4.20 |
| Pb(Lead) | 18.0 | 0.20 | 0.50 | 4.90 |

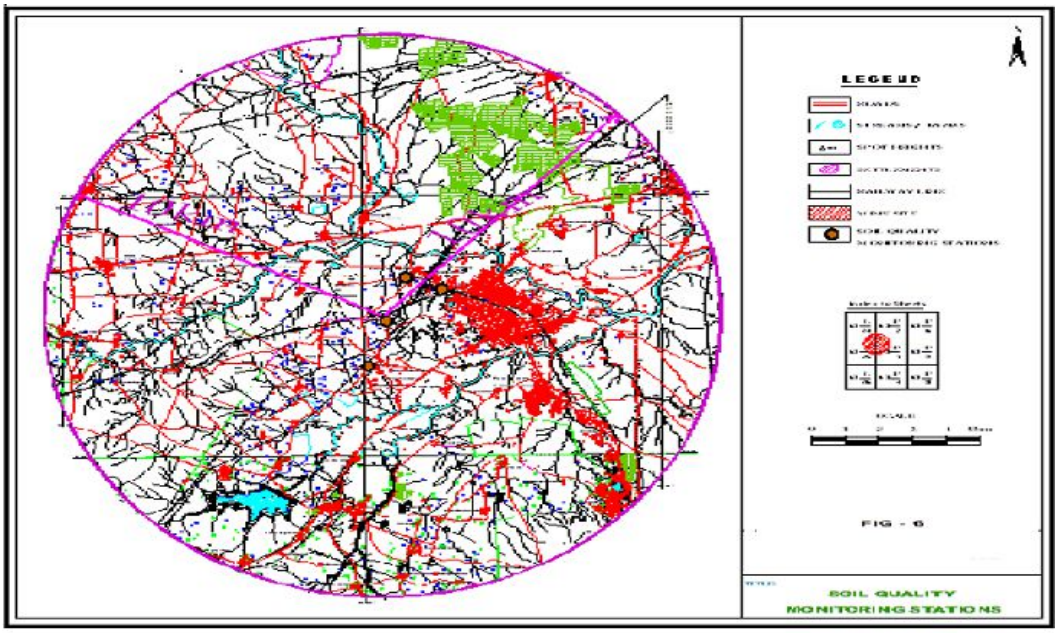


**Figure 2** Soil quality monitoring stations

The present study is aimed at identifying the potential environmental impacts on soil due to the various project activities, assessment of impact, assessment of the associated risks and at developing an environmental management and monitoring plans for proper mitigation of any adverse environmental impact .The study evaluation of soil quality role observed the soil characteristics include destruction of soil profile, changes in soil productivity, increased erosion and subsequent loss of agricultural soils and land use changes. On the whole it can be concluded that the impacts due to installation of additional unit with the adoption of mitigation measures established by the EIA Process, would allow compliance with appropriate standards and confine negative impacts within acceptable limits. The result of Environmental Impact Assessment of the kothagudem thermal power plant has to be Environmentally Feasible in order to gain Environmental Permit, which is the first and foremost requirement for Operational Permit.

## REFERNCES

[1] Assessment of trace metal distribution and contamination in surface soils of Hong Kong-T.B CHEN, J.W.C.WONG, H.Y ZHOU, M.H WONG ; Received 9 July 1996, Accepted 5 December 1996, Available online 15 June 1998**.**

[2] All India Soil and Land Use Survey (AISLUS) (1990). Watershed Atlas of India. Department of Agriculture and Co-operation. IARI Campus, New Delhi.

[3] All India Soil and Land Use Survey (AISLUS) (1989). Soil Survey Manual. Department of Agriculture and Co-operation. IARI Campus, New Delhi.

[4] Beck L, Römbke J, Breure AM & Mulder C (2005). Considerations for the use of soil ecological classification and assessment concepts in soil protection. Ecotoxicology and Environmental Safety, 62(2) 189-200.

[5] Bohn HL, McNeal BL & Connor AG (1985). Soil chemistry. 2ndedition, Wiley-Inter Science Publications, New York, USA.

[6] Cambra K, Martínez T, Urzelai A & Alonso E (1999). Risk analysis of a farm area near a lead and cadmium contaminated industrial site. Soil and Sediment Contamination, 8 527-540.

[7] Davies DJA, Watt JM and Thornton I (1987). Lead levels in Birmingham dusts and soils. Science of the Total Environment, 67 177-185.

[8] Davies DJA, Watt JM and Thornton I (1987). Lead levels in Birmingham dusts and soils. Science of the Total Environment, 67 177-185.

[9] D. Satish Chandra and B. V. T. VasanthaRao M. V. Raju, SS. Asadi, Preparation of Compost for Remediation of Contaminated Soils and Sediments of PeddaCheruvu: A Model Study International Journal of Applied Environmental Sciences, volume:9,

[10] Evaluation of Soil Quality using Geospatial Technology SS. Asadi , B. Harish Kumar , M. Sumanth, P. Sarath Chandra, T. Eswar Rao5, International Journal of Applied Chemistry. ISSN 0973-1792 Volume 12, Number 1 (2016) pp. 37-50.

[11] Graham RD, Ascher JS & Hynes SC (1992). Selecting zinc-efficient cereal genotypes for soils of low zinc status. Plant Soil, 146 241-250.

[12] Herrick, J.E., (2000); soil quality; an indication for sustainable land management. Applied soil ecology. 15:75-83.

[13] Karlen, D.L., Andrews, S.S., Wrinhold, B.J., and Doran, J.W., 2003: Soil quality; Human kind's foundation for survival. Research editorial, JSWC.58 (4) 171-178. 12.K.A.Kelling and EE. Schulte., Soil and applied calcium and magnesium, understanding plant nutrients. A – 2523, 2524.

[14] Lehoczky É, Szabó L, Horváth S, Marth P &Szabados I (1998). Cadmium uptake by lettuce in different soils. Communications in Soil Science and Plant Analysis, 29 1903-1912.

[15] SS.Asadi, P. Neela Rani, B.V.T. VasanthaRao, M.V. Raju / International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com Vol. 2, Issue 2,Mar-Apr 2012, pp.573-580.

[16] SS. Asadi and S. Lakshmi Narayana ,G. S. Sarma, Geospatial Data Based Modelling For Evaluation Of Soil Properties: A Modal Study Volume 11, Number 1 (2016), pp. 245-258.

[17] State Soil Survey, Department of Agriculture, Hyderabad 1988, Soils of Andhra Pradesh, Legend. pp:1:30.

[18] Wei-Xin Li, Xu-Xiang Z, Bing W, Shi-Lei S, Yan-Song C, Wen-Yang P, Da-Yong D & Shu-Pei C (2008). A comparative analysis of environmental quality assessment methods for heavy metal-contaminated soils. Pedosphere, 18(3) 344-352.

[19] Abdullah Anwar, Sabih Ahmad, Yusuf Jamal and M.Z. Khan, Assessment of Liquefaction Potential of Soil Using Multi-Linear Regression Modeling, *International Journal of Civil Engineering and Technology,* 7(1), 2016, pp. 373-415.

[20] K. Hemalatha Reddy and K. Sai Kala, Comparison of Vertical Settlement in Storeyed Building in Different Foundations of Various Soils. *International Journal of Civil Engineering and Technology,* 8(1), 2017, pp. 748–755.